Western Michigan University’s Climate Action Plan

Implementation Status

November 6, 2015

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Outline

- Description of the WMU plan, in broad strokes
- Status vis-à-vis the available GHG inventory data
- Issues and challenges going forward
- Questions and discussion time
Background

A. WMU was already in pretty good shape before signing on to the ACUPCC in 2009
B. Leadership was on board, and had signed the Talloires declaration in 2008
C. Western had a longstanding “Green quasi-revolving fund” in place
D. We had a natural gas cogeneration plant providing electricity and heat through our own distribution grids
E. Many demand reduction strategies had already been adopted
F. As a moderate-sized, research-intensive university in the upper midwest climate, our GHG emissions were already about 20% below the US average for Ph.D. granting schools
G. We already had Harold Glasser
Climate Action Plan

- Written by committee in 2011, adopted and submitted Spring 2012
- System boundary: WMU in Kalamazoo
  Includes a separate Engineering campus, but no regional centers. Does not include the College of Aviation in Battle Creek, nor the new WMU medical school
- We assumed very little future growth in the student body or physical plant. Current enrollment is about 24,000, we allowed for ~26,500 in future. (The trend is not in this direction.)
- No major increase in revenue foreseen for the next few decades
- We assumed no major changes to the way we do business
- We tried to be realistic, could be accused of being too conservative
- A small amount of offsetting was included
- We targeted net climate neutrality by 2065
ACUPCC chosen
Climate Neutrality Dates

395 institutions with climate neutrality dates

WMU chose 2065
Baseline is **2009** data

**GHG emissions, in metric tons** $\text{eCO}_2$

<table>
<thead>
<tr>
<th>Scope</th>
<th>Emissions (metric tons)</th>
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<tbody>
<tr>
<td><strong>Scope I</strong></td>
<td></td>
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<tr>
<td>Stationary Combustion</td>
<td>67,410</td>
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<tr>
<td>Mobile combustion (campus vehicles)</td>
<td></td>
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<tr>
<td>Fugitive emissions</td>
<td></td>
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<tr>
<td><strong>Total</strong>:</td>
<td>123,550</td>
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<tr>
<td><strong>Scope II</strong>:</td>
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<tr>
<td>Purchased power from utility</td>
<td></td>
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<td><strong>Scope III</strong>:</td>
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<tr>
<td>All Commuting (25740)</td>
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<tr>
<td>Travel (outsourced but paid for by the university, incl. study abroad)</td>
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<tr>
<td>Solid Waste</td>
<td></td>
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<tr>
<td>Wastewater treatment</td>
<td></td>
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<tr>
<td>Overhead from scope II</td>
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**Total**: 123,550
A finer breakdown at baseline

GHG inventory (2009)

- Stationary combustion: 50.9%
- Emissions only

- Bold: Scope I

**Emissions by Category:**

- Purchased electricity: 14.5%
- Commuting: 21%
- Campus vehicles: 0.9%
- Air travel: 5.0%
- Fugitive emissions: 2.8%
- Solid waste: 2.6%
- Wastewater: 2.4%
- Off-gas emissions: 2.8%
- Solid waste: 2.6%
- Wastewater: 2.4%
GHG reduction strategies
Starting with the small stuff

- All university-owned vehicles to be zero-net-carbon fueled or electric by 2040.
- Encourage alternatives to air travel. Require purchased offsets for 100% of air travel by 2020.
- Eliminate fugitive emissions by 2050.
- Continue to increase recycling and reduce the solid waste stream. Develop local composting (affects both solid waste and wastewater). 80% reduction in GHG impact in these two categories combined by 2065.
- A small amount of absorption and offsets proposed to balance the remaining emissions.
GHG reduction strategies: the BIG STUFF

That leaves the three major sources:

- Stationary combustion (our own power plant)
- Electricity purchased from the local utility company
- Commuting (by students and employees)

The first two combined satisfy the need for centralized power, currently in the form of electricity and pressurized steam for heating.
Strategies related to Commuting

- Increase the amount of desirable on-campus housing for students significantly. Add 3500 beds by 2035.
- Facilitate car-pooling for employees who work regular hours. (online tools?)
- Continue to support/improve mass transit options.
- Incentivize alternatives to single-occupancy automobiles via:
  Infrastructure improvements, smoother connections for non-motorized traffic in several directions, better snow clearing, clarifying conflict points between pedestrians, bikes and cars, financial incentives through the parking pass system?
General reduction of energy demand is crucial to our plan

- Co-chair Chris Caprara will talk about this aspect in the next presentation

Current energy demand

- Average annual consumption over the last few years: $8.3 \times 10^7$ kWh of electricity, $5.5 \times 10^{11}$ Btu for heating
- September peak for electricity demand: $\sim 11$ MW
- Mid-winter peak for heat: $\sim 1.3 \times 10^8$ Btu/hour.
Trend in annual electricity use

Total Electricity use per building floor area

- Actual scaled electricity use
- 2% annual decrease
- Expon. (Actual scaled electricity use)
Trend in Steam use

Steam used per floor area

relative units


Steam use per gross floor area

2% line

Expon. (Steam use per gross floor area)
Annual Electricity use by physical plant
Scaled to gross building square feet

Projection
Projected demand curve

- Purchased electricity
- Stationary combustion

Primary Energy

- 2011 to 2065
- Tons of CO2
Centralized power

- Our natural gas-fired co-generation facility is hard to beat, for a reliable, affordable source of power with relatively low GHG emissions.
- This is one reason that our goal for climate neutrality is so far in the future. The power plant is operating well, and we did not see any near-term zero-carbon way to replace it that is also economical.
- Missing from our CAP are specific recommendations for supplying the remaining demand for heating, cooling, and electrical energy in a way that emits much less GHG per energy unit.
Total installed PV capacity is now about 300 kW, but can supply much less than 1% of current electrical energy use in a year.

Distributed renewable energy will certainly be part of the picture.
How are we doing?

Projections

Actual?
Subcommittee members

- Paul Pancella, Chair, Physics faculty
- Haluk Aktan, Engineering faculty
- Jeff Alexander, Transportation services
- Steve Bertman, Chemistry faculty
- Chris Caprara, Facilities management, Energy
- Lu DeBoef, Human Resources
- Duane Hampton, Geosciences faculty
- George Jarvis, Power Plant manager
- Stephan Keto, Natural Areas manager
- Devon Miller, Buildings
- John Miller, Chemistry faculty
- Carolyn Noack, Recycling and Solid Waste
- Chris Pyzik, Facilities management, planning
End of presentation

- Time for questions and/or discussion
V Research Efforts

- Carbon capture and sequestration
- Advancing practical, local, energy storage methods
- Renewable energy generating technologies
- New technologies for energy management and conservation in buildings and manufacturing
- Biomass as an energy source for stationary power generation or as fuel for transportation
Solar PV financial projections

- **Installed cost per rated capacity ($/kW)**
- **Avoided cost of electricity, ($/kWh)**

- Blue line: installed cost/rated kW capacity
- Red line: avoided cost/kWh produced
De-centralized Renewable Electricity

KWh supplied/year

2011 2014 2017 2020 2023 2026 2029 2032 2035 2038 2041 2044 2047 2050 2053 2056 2059 2062 2065

Net annualized investment, solar PV

$340,000
$290,000
$240,000
$190,000
$140,000
$90,000
$40,000
-$10,000

2011 2014 2017 2020 2023 2026 2029 2032 2035 2038 2041 2044 2047 2050 2053 2056 2059 2062 2065 2068
Original CAP committee

- Paul Pancella, Chair, Physics faculty
- Haluk Aktan, Engineering faculty
- Jeff Alexander, Transportation services
- Dave Barnes, Geosciences faculty
- Steve Bertman, Chemistry faculty
- Kate Binder, graduate student, Office for Sustainability
- Chris Caprara, Facilities management
- Cari DeLong, Natural Areas manager
- Kirk Dillery, Facilities management, Energy
- Duane Hampton, Geosciences faculty
- Sarah Hill, Environmental Studies faculty
- George Jarvis, Power Plant manager
- Steve Kohler, Environmental Studies chair
- John Miller, Chemistry faculty
- Chris Pyzik, Facilities management, planning
- Yusuke Saito, undergraduate student